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## Angioplasty

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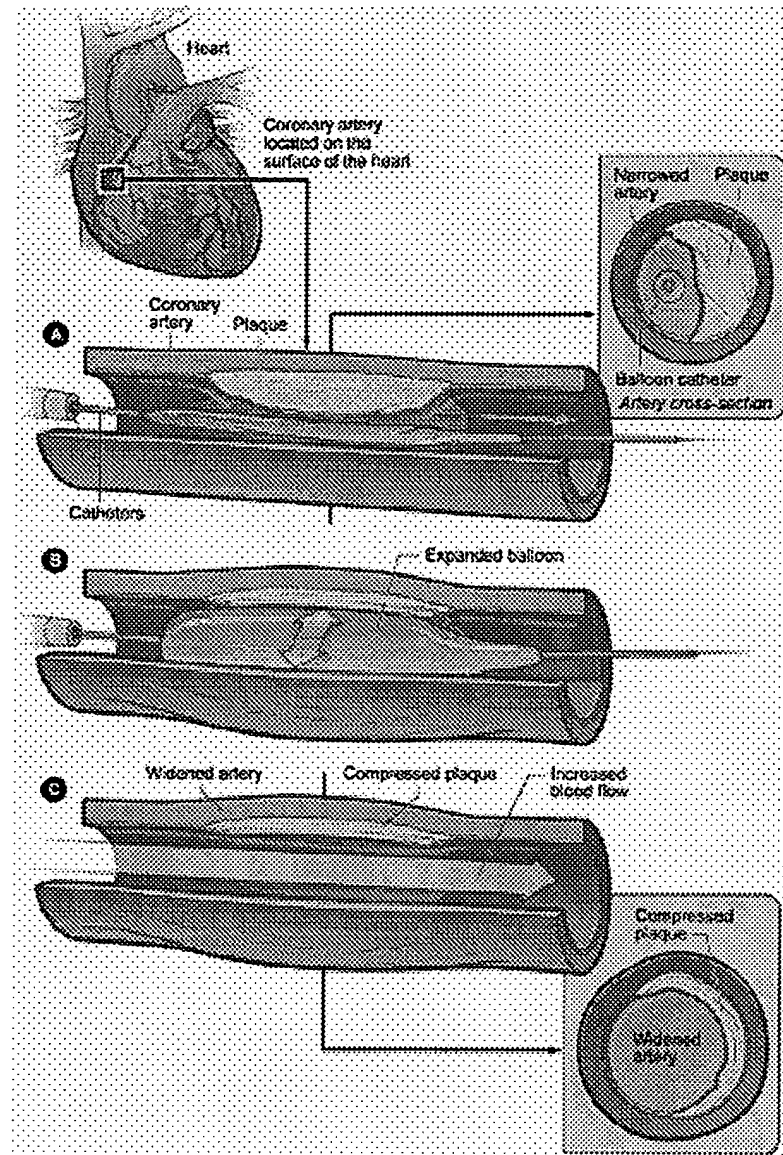
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### What Is Coronary Angioplasty?

**Coronary angioplasty** (AN-jee-oh-plas-tee) is a medical procedure used to restore blood flow through a narrowed or blocked artery in the heart. The arteries of the heart (the **coronary** arteries) can become narrowed and blocked due to buildup of a material called plaque on their inner walls. This narrowing reduces the flow of blood through the artery and can lead, over time, to **coronary artery disease** and heart attack. In **angioplasty**, a thin tube with a balloon or other device on the end is first threaded through a blood vessel in the arm or groin (upper thigh) up to the site of a narrowing or blockage in a **coronary** artery. Once in place, the balloon is then inflated to push the plaque outward against the wall of the artery, widening the artery and restoring the flow of blood through it.



The illustration shows a cross-section of a **coronary** artery with plaque buildup. The **coronary** artery is located on the surface of the heart. Figure A shows the deflated balloon catheter inserted into the narrowed **coronary** artery. In Figure B, the balloon is inflated, compressing the plaque and restoring the size of the artery. Figure C shows normal blood flow restored in the widened artery.

**Angioplasty** is used to:

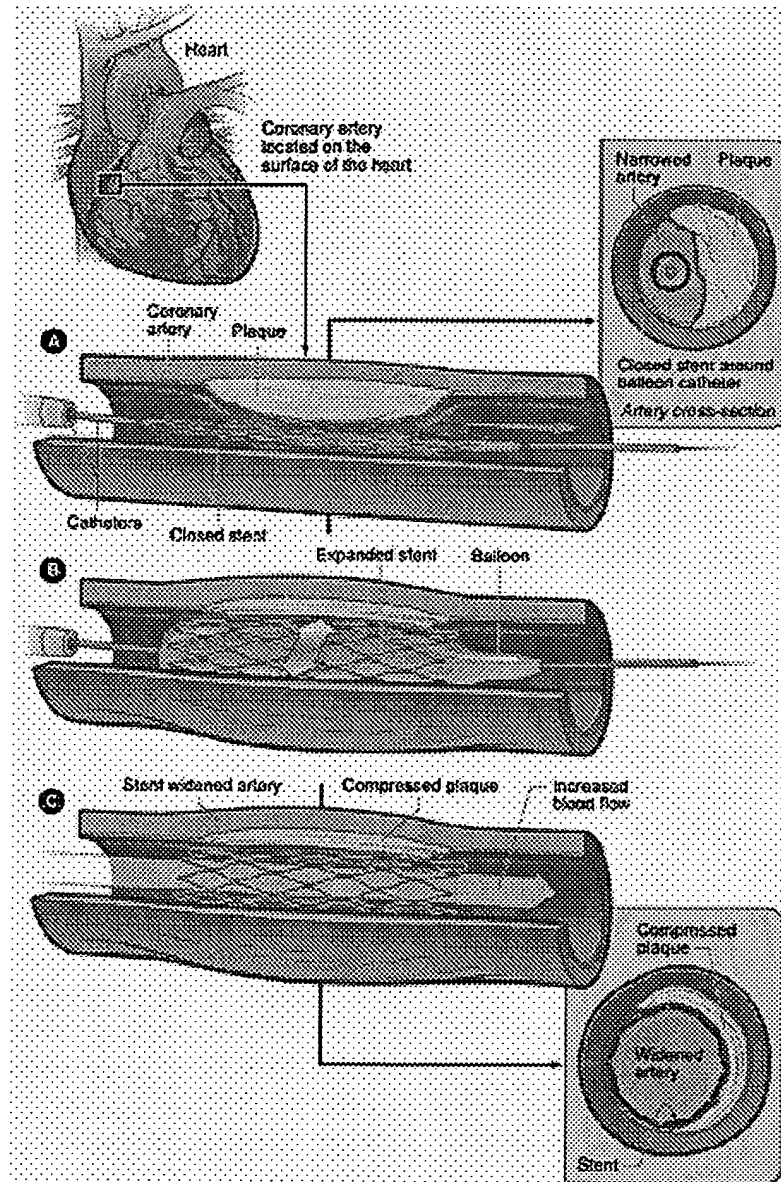
- Relieve chest pain caused by reduced blood flow to the heart.
- Minimize damage to the heart muscle during a heart attack. This damage occurs when blood flow is totally cut off to an area of the heart.

**Angioplasty** was first used in 1977. A tiny balloon was used to open or widen narrowed arteries. Since then, new devices and medicines have improved the procedure and made it appropriate for more people. The improvements include:

- **Stents.** A stent is a tiny mesh tube that looks like a small spring. The stent is inserted in the area where the artery is narrowed to keep it open. Some stents are "coated" with medication to help prevent the artery from closing again. Stents are used in most angioplasties except when an artery is too small for a stent to fit.
- When a stent is used, in 2 out of 10 people the artery will close again within the first 6 months.
- When a stent is not used, in 4 out of 10 people the artery will close again within

the first 6 months.

- **Plaque removers.** Many kinds of plaque removers exist. They are used to cut away plaque that narrows the inside of the arteries.
- **Laser.** A laser is used to dissolve or vaporize plaque. First approved in 1992, laser devices are used in many major U.S. medical centers.



The illustration shows the placement of a stent in a **coronary** artery with plaque buildup. The **coronary** artery is located on the surface of the heart. Figure A shows the deflated balloon catheter and closed stent inserted into the narrowed **coronary** artery. In Figure B, the balloon is inflated, expanding the stent and compressing the plaque to restore the size of the artery. Figure C shows normal blood flow restored in the stent-widened artery.

Today, **angioplasty** is performed on more than 1 million people a year in the United States. The procedure is best done:

- By doctors who do at least 75 angioplasties a year
- In hospitals that do at least 400 angioplasties a year




Research on **angioplasty** continues to:

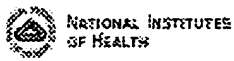
- Increase its safety

- Prevent the artery from closing again
- Make it an option for more people

January 2006

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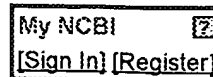
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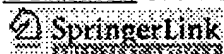
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1: Z Kardiol. 1998 Sep;87(9):699-706.

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## [Prevention and treatment of restenosis after percutaneous transluminal coronary angioplasty]

[Article in German]

**Hehrlein C, Bode C, Brachmann J, Kubler W.**

Medizinische Klinik III, Heidelberg.

Restenosis is a clinical problem after coronary angioplasty associated with major ischemic events or repeat interventions in 20-50% of the patients undergoing this procedure. Major efforts have been undertaken in the past decade to successfully prevent or treat restenosis but no pharmacologic approach to the problem has as yet been identified to be effective enough in clinical conditions. New strategies to cope with restenosis are targeted by local application of ionizing radiation which markedly reduces cell proliferation after angioplasty in animal experiments. Preliminary clinical trials indicate that endovascular radiation therapy is a safe and effective means to treat restenosis. Randomized, multicenter studies with long follow-up periods are needed to support these early results.

Publication Types:

- Review

PMID: 9816652 [PubMed - indexed for MEDLINE]

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## Cardiac Catheterization, Coronary Angiogram, and Percutaneous Coronary Intervention (PCI)



Your doctor has recommended that you have a cardiac catheterization, coronary angiogram, and/or possible **percutaneous coronary intervention** (angioplasty or stent placement) as part of your continuing medical care. Your procedure is performed in a specialized room, the Cardiac Cath Lab, on the Pacific Campus. Here, a team of cardiologists, registered nurses, and technologists work closely together to provide your care. It is their goal to make your experience as comfortable as possible.

### Are You at Risk for a Heart Attack?

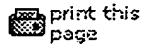
Take our confidential online [Heart Risk Assessment](#) to find out more.

**Note: Each person is unique and therefore each person's condition will vary. This is general information about these procedures. If you have additional questions or concerns, please ask the staff.**

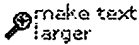
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- [What is a Percutaneous Coronary Intervention \(PCI\)?](#)
- [What Can I Expect Before the Procedure?](#)
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### What is a Cardiac Catheterization and Coronary Angiogram?

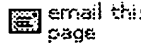
A cardiac catheterization is an invasive, **non-surgical procedure** done to study the arteries that bring blood to the heart muscle and to check the function of the main pumping chamber of your heart. During a cardiac



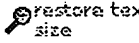
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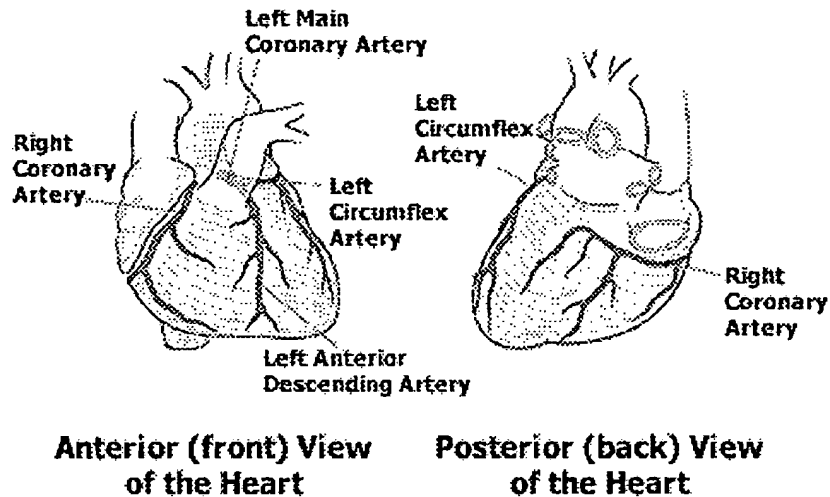


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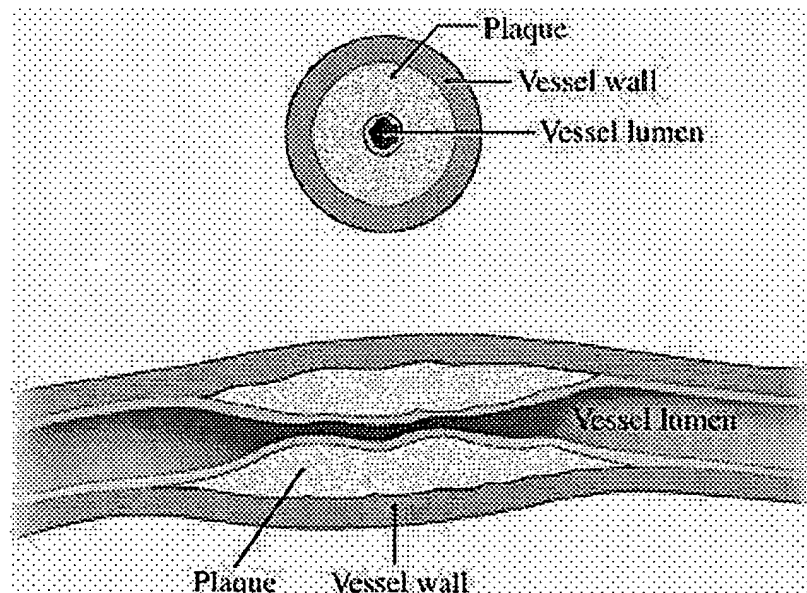
catheterization, the cardiologist inserts a small, hollow tube (catheter), into an artery or vein, and then guides it into the heart using x-ray. The cardiologist injects contrast (x-ray dye) through the catheter to outline the arteries and to show any blockages or narrowings that may exist. The results of these tests will assist your doctor in making the diagnosis of **Coronary Artery Disease (CAD)**. Most patients have little or no discomfort during a cardiac catheterization. However, you may feel a hot, flushing sensation for several seconds when the contrast is injected into the main pumping chamber of the heart. The nursing and medical staff will give you medication and reassurance throughout the procedure to ensure your comfort.



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### What is a Percutaneous Coronary Intervention (PCI)?

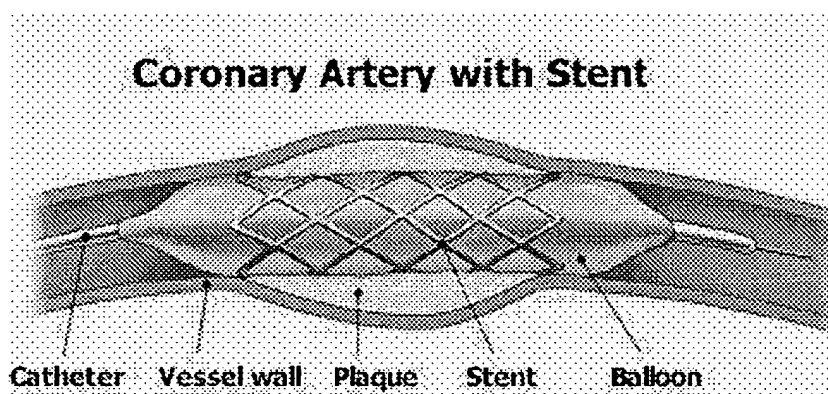
PCI is a treatment procedure that unblocks narrowed **coronary** arteries without performing surgery. During this procedure, your cardiologist determines the best treatment for your condition. Treatment will vary from patient to patient.



**PCI may include one or more of the following treatments:**

**Balloon catheter angioplasty:** During this procedure, the cardiologist inserts a cardiac catheter with a small balloon around it into the **coronary** artery. The cardiologist then places the balloon in the narrowed area of the artery and expands it with liquid. This pushes the plaque (blockage) to the sides of the artery where it remains. This technique reduces the narrowing in the artery and restores the normal size of the artery. The cardiologist removes the balloon catheter at the end of the procedure.

**Stent:** The cardiologist places a small, hollow metal (mesh) tube called a "stent" in the artery to keep it open following a balloon angioplasty. The stent prevents constriction or closing of the artery during and after the procedure. Drug-eluting stents are now used. These stents are coated with medication that helps prevent narrowing of the artery.



**Rotational Atherectomy:** During this procedure, the cardiologist uses a specialized instrument to break up rock-hard plaque with calcium build-up from the blood vessel wall into tiny pieces. You may experience some discomfort such as chest pain, pressure or tightness in your chest during this procedure. Medications may be given to ease the discomfort. This procedure may last for 30 seconds to one minute.

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## **What Can I Expect Before the Procedure?**

**Consult with your doctor about your medications:**

- Bring a list of all your current medications with you to your appointment, including strength (dose) and frequency (time taken). This includes any over-the-counter medications, herbal preparations or vitamins.
- Ask your doctor about whether or not to take your routine medications with a sip of water before coming to the hospital.
- Usually, aspirin **should** be taken prior to cardiac catheterization and



PCI.

- **If you are taking blood-thinning medications such as Coumadin (Warfarin), check with your doctor about when to stop taking these medications prior to the procedure.**
- If you are taking medications for diabetes, e.g., Glucophage (Metformin) or Glucovance (Glyburide and Metformin), you may be advised to stop these medications **before** the procedure and re-start these medications **after** the procedure, as directed by your doctor.
- Be sure to tell your doctor if you have had an allergic reaction to x-ray dye (contrast), iodine or seafood, or have a history of bleeding problems.

**Prepare the night before:**

- Drink plenty of fluids the evening before the test, unless otherwise directed by your doctor.
- **Do not eat or drink anything after midnight, the night before your procedure, unless otherwise directed by your doctor.**
- **You must arrange for a relative or friend to drive you home. You may not drive for 24 hours following the procedure.**

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**What Can I Expect on the Day of the Procedure?**

- Take medications that your doctor has **specifically** instructed you to take on the day of your procedure with a **sip** of water.
- Arrive at least 2 hours before your scheduled procedure.  
**Note:** If you are scheduled for a 7 a.m. procedure, please arrive at 6 a.m.
- Most scheduled procedures are performed on time. However, your scheduled procedure time may be delayed if there are emergency cases.
- Family members and friends are invited to wait in a designated waiting area. The cardiologist will contact them there after the procedure.

**While you are in the Ambulatory Care Unit (ACU) and Cath Lab holding area:**

- Your nurse places a small intravenous (IV) catheter (tube) in your arm. The IV is needed to give you medications to help you relax and make sure that you are comfortable throughout the procedure.

- You will be asked to sign several consent forms stating that you understand the procedure. These forms may include consent for cardiac catheterization, **coronary** angiogram, PCI, emergency **coronary** bypass surgery, and blood product transfusion, if needed.
- The nurse shaves either your groin and/or arm area (the insertion site for the cardiac catheter) to remove hair and prevent infection.
- Then, the nurse may insert a small tube (urinary catheter) into your bladder to drain your urine. The catheter will be removed after your procedure.

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### **What Can I Expect During the Procedure?**

- The nurse or technologist brings you into the Cardiac Cath Lab procedure room.
- The nurse gives you medication through your IV to help you relax and to ensure your comfort throughout the procedure.
- The nurse cleans your groin/arm area with a special anti-bacterial soap, and covers you with sterile drapes to prevent infection.
- The cardiologist injects a numbing medication (local anesthesia) into the groin/arm area. This may feel like a mild sting which lasts only a few seconds and will keep the area pain free.
- Next, the cardiologist places a small plastic tube called a sheath through the skin and into the artery. You may feel a slight pressure at that moment.
- Immediately report any chest pain or discomfort during the procedure.
- Once the sheath is in place, the cardiologist inserts a catheter into the sheath and advances it toward the heart. Then, x-ray pictures are taken as the contrast is injected. You may feel a "hot flash" or a flushing sensation during contrast injection.

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### **What Can I Expect After the Procedure?**

After the procedure, you will return to the holding area for a recovery period before you go home.

- The sheath will be removed. The timing of the sheath removal depends upon the results of your blood tests (bleeding time) and other considerations.
- Manual pressure, a compression device, or a "closure device" may be used to seal the artery puncture site. Closure devices may include a

collagen plug, a compression device (Femostop®), or a surgical stitch (Perclose®).

- If the insertion site was in your arm, you will have a compression band placed around the puncture site. The nurse will slowly release the compression band and place a dressing over the puncture site.
- If you have had a PCI, you will be transferred to a special cardiac care unit for an overnight stay. There, nurses will continue to monitor your condition closely. Most patients go home the following day after a PCI.
- **After the procedure, you will remain flat in bed for 6 or more hours to prevent bleeding from the catheter/sheath insertion site. You may not sit up until several hours after the sheath is removed and the blood vessel is sealed by manual pressure or a closure device has been placed.** Your nurse may raise the head of your bed slightly to allow you to eat and drink beginning one hour or more after your procedure.
- You may experience a backache after the procedure. Report any backache to your nurse. Your nurse will give you medication if needed.
- **Call your nurse immediately if you are experiencing any chest pain, lightheadedness, bleeding, or severe back pain.**
- The nursing staff will give you detailed instructions about what to expect when you go home. This will include symptoms to watch for and when to call your doctor.
- If you experience pain, moisture or any unusual sensation at the cath site, call your nurse.
- If you have to cough or sneeze, apply gentle pressure at the site with your hand.

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### **When Do I Get My Results?**

Your cardiologist will notify you, your family member(s) or friend(s) of the test results after the procedure.

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### **More Ways to Learn**

- Learn more about the [heart](#).
- Cardiac Rehabilitation is a program offered at California Pacific on the referral of your doctor. For more information about this service, call (415) 600-3361 or visit [Healthy Heart Services - Cardiac](#)

Rehabilitation.

- Visit the [American Heart Association](#) Web site.
- Interactive Tools
  - Measure your readiness to [quit smoking](#).
  - Determine how smoking affects your chance of having a [heart attack](#) in the next 10 years.

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### Frequently Asked Questions

**Question: What is a cardiac catheterization?**

Answer: Cardiac catheterization is an invasive, non-surgical procedure done to study the structure of the arteries that bring blood to the heart muscle and to check the function of the main pumping chamber of your heart.

**Question: What is percutaneous coronary intervention (PCI)?**

Answer: **Percutaneous coronary intervention** (PCI) is a treatment procedure that unblocks narrowed **coronary** arteries without performing surgery.

**Question: When can I go home?**

Answer: Usually, after PCI, patients remain in the hospital for an overnight stay.

**Question: When will I get the test results?**

Answer: Your cardiologist will give you and your family member the results of your test after the procedure.

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Medical Illustrations: Christine Gralapp

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Note: This information is not meant to replace any information or personal medical advice which you get directly from your doctor(s). If you have any questions about this information, such as the risks or benefits of the treatment listed, please ask your doctor(s).

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☐ 1: Cardiologia. 1991 Dec;36(12 Suppl 1):309-20.

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## [Restenosis after coronary angioplasty: its pathogenesis and prevention]

[Article in Italian]

Marzocchi A, Marrozzini C, Piovaccari G, Fattori R, Castriota F, D'Anniballe G, Branzi A, Magnani B.

Istituto di Malattie dell'Apparato Cardiovascolare, Universita degli Studi, Bologna.

Restenosis after coronary angioplasty is due to a proliferation of smooth muscle cells growing in the vascular lumen, beneath the residual fragments of the atherosclerotic plaque, as seen in necropsy studies and examination of the specimens removed by atherectomy. At the histological analysis thrombi or their fibrocellular organization are not usually detectable. Smooth muscle cell proliferation leading to restenosis is very similar to the one observed in the experimental models of response-to-injury, so that these models are used to investigate into the pathogenetic mechanisms of restenosis. The main stimulus to the loss of the contractile phenotype and to the start of the smooth muscle cell proliferation is represented by the growth factors delivered by platelets adhered to the disendothelialized wall and by the smooth muscle cells themselves, stretched during the dilatation. Other stimuli can be growth factors delivered by monocytes and fibroblasts, by thrombin, endothelin, angiotensin and interleukin 1. The elastic recoil of the vessel wall, the plaque debris and the regional wall shear stress can also contribute to restenosis. The restenosis tissue is different from the atheromatous plaque in that it is almost only constituted by smooth muscle cells and intercellular matrix, while atheroma is much more complex due to the presence of various kinds of cells, of necrotic debris and lipid substances. The smooth muscle cells proliferation also contributes to the pathogenesis of atherosclerosis, but the stimuli starting this process have not been clarified yet; moreover this process is much slower than restenosis, interacting with several factors. Encouraging results have been achieved in the prevention of restenosis after angioplasty in experimental models, but not in man. In order to reduce the incidence of restenosis one should improve the results of angioplasty, even by the use of atherectomy and intracoronary stents. Among pharmacologic approaches anticoagulants, heparin, antiplatelet agents, calcium-channel blockers, corticosteroids all proved ineffective. Studies are in progress evaluating the effect of inhibitors of platelet-derived growth factor (PDGF), antitumor agents and radiation therapy, hirudin, angiotensin-converting enzyme inhibitors and HMG-CoA reductase

inhibitors.

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PMID: 1841786 [PubMed - indexed for MEDLINE]

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